Chandra X-Ray Observatory

X rays are a high-energy wavelength in the electromagnetic spectrum. Many stars, supernova, quasars and galaxies emit x rays, so observing these objects in that wavelength will reveal much about them.

The Chandra Observatory (formerly called the Advanced X-ray Astrophysics Facility–AXAF) the world's most powerful x-ray telescope, was launched on July 23, 1999, to view x-ray sources from space. Astronomers must have this observatory in space because the Earth's atmosphere absorbs and blocks celestial x-ray radiation from reaching the ground.

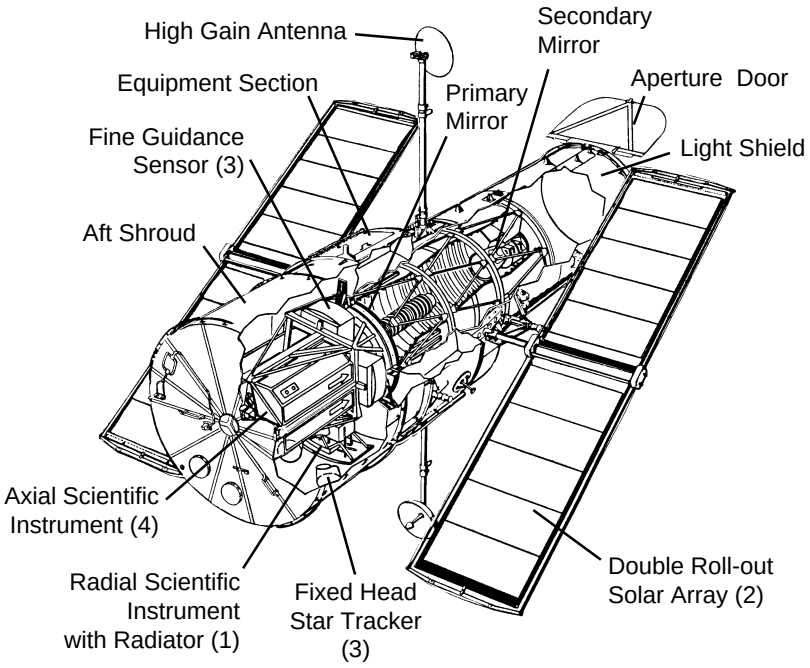
Chandra flies 200 times higher than the Hubble Space Telescope and its orbit takes it one-third of the way to the Moon. The cylindrical glass mirrors in the Chandra are the largest of their kind and the smoothest ever created. Chandra and its upper stage was the heaviest payload ever launched on the Shuttle.

The Chandra design and development program was managed by MSFC. The observatory's telescope was tested and certified at the MSFC X-Ray Calibration Facility.

The Hubble Space Telescope

A new era in astronomy began as Shuttle astronauts released the Hubble Space Telescope into orbit on April 26, 1990. With its vantage point above Earth's atmosphere Hubble has shown the birth and death of stars, colliding galaxies, stellar plumes, gas rings, nebula clouds, comet impacts on Jupiter, and storms on Saturn, all with greater clarity and brightness than humans have ever seen before. Hubble is fulfilling its mission to collect knowledge and discover a new perspective of the universe.

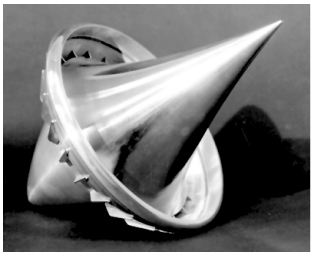
The Hubble telescope uses a Cassegrain reflector system that has a hyperbolic-shaped mirror. The design is optimized for focusing the visible spectrum. The development and assembly of the Hubble was directed by MSFC.



Investigating Laser Light Craft

The futuristic idea of a small laser-propelled spacecraft like the model shown here is being studied at MSFC.

The laser on the ground fires up under the specially shaped craft. The focused infrared laser beam is absorbed by the air inside the engine, creating a laser supported detonation. The high-pressure, high-temperature plasma created by the laser absorption cools and expands out the rear of the vehicle producing the thrust which propels the lightcraft into the sky. MSFC is fabricating lightcraft bodies, developing beam directors, and investigating improved vehicle and laser concepts.

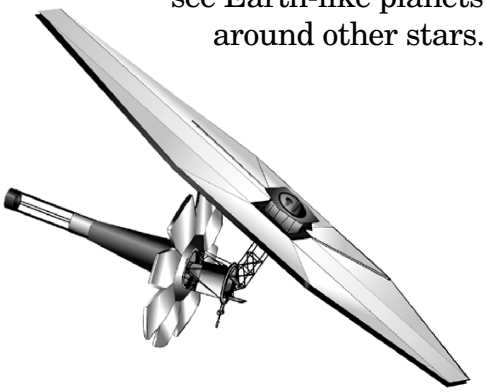


Improving Observatory Alignment

The Hobby-Eberly telescope (HET) near Ft. Davis, Texas, is a 9-meter diameter telescope tailored for spectroscopy. It has a special mirror with 91 segments and features an innovative, low-cost tracking system. MSFC is designing a mirror Segment Alignment Maintenance System on the HET to improve the mirror performance.

Next Generation Space Telescope

The next space telescopes larger than Hubble will have to be made with special lightweight mirrors. MSFC is testing new materials and assembly techniques to make giant reflectors that will fold up for launch and then open in space. These telescopes will be big enough to allow scientists to see Earth-like planets around other stars.



Besides working with the large space observatories Hubble and Chandra, the MSFC optics group has done design, assembly or testing on the following projects.

Space Station Windows

The windows in the Space Station are for the crew to view external operations. MSFC designed the frames for the windows and tested the transmission quality of the glass.

Composite Infrared Spectrometer (CIRS) for the Cassini Saturn Spacecraft

The CIRS is a set of interferometers designed to measure infrared emissions from atmospheres, rings, and surfaces to determine their compositions and temperatures. MSFC made and tested the mirrors for the CIRS instrument. Cassini was launched on October 6, 1997, and will arrive at Saturn on July 1, 2004.

Soft X-Ray Imager (SXI)

SXI is designed to obtain a continuous sequence of corona x-ray images from the Sun to monitor solar activity for its effects on the Earth's upper atmosphere. It uses a Wolter grazing incidence mirror similar to the type in Chandra. SXI was assembled and tested at MSFC and will be launched as part of a Geostationary Operational Environmental Satellite (GOES) weather satellite.

Lightning Imaging System (LIS)

The LIS is a space-based instrument used to detect the distribution and variability of lightning on Earth. The measurements are being used to study storm convection and global precipitation. LIS was made at MSFC and launched on November 28, 1997, in a weather satellite.